PATENT ABSTRACTS OF JAPAN

(11)Publication number : 2001-042822
(43)Date of publication of application : 16.02.2001

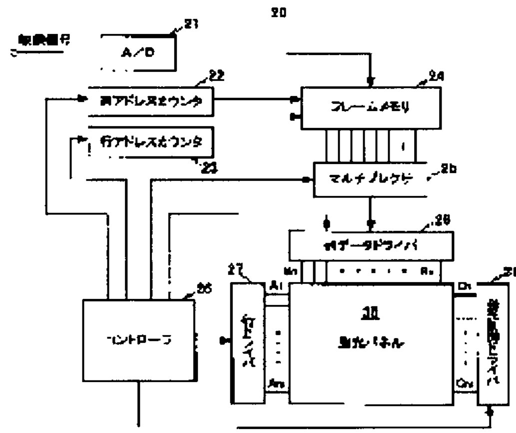
(51)Int.Cl. G09G 3/30
// H05B 33/14

(21)Application number : 11-220291
(22)Date of filing : 03.08.1999

(71)Applicant : PIONEER ELECTRONIC CORP
(72)Inventor : ISHIZUKA SHINICHI

(54) **ACTIVE MATRIX TYPE DISPLAY DEVICE**

(57)Abstract:
PROBLEM TO BE SOLVED: To obtain a display device, in which no dispersion of luminance gradation exists over the entire surface of a display panel, by providing a means to stop the light emitting of light-emitting elements after a prescribed light emitting period has elapsed for every subfield.
SOLUTION: A controller 26 controls a light-emitting control driver 31 to supply control signals to make a switching circuit conductive and to make organic electroluminescence(EL) elements of the pixels having the data indicating light-emitting emit light. Moreover the controller 26 supplies a signal, which instructs stopping of light-emitting of the organic EL elements of the driver 31 when a beforehand determined light emitting interval time elapses for a first subfield. The driver 31 supplies control signals to stop light-emitting of the organic EL elements to all the switching circuits of a first row and the elements comes to be in non-light emitting state. Then, the controller 26 repeats similar operations for the case of a first subfield, and corresponding light emitting is conducted from the first subfield to the eighth subfield.



CLAIMS

[Claim(s)]
[Claim 1]A display using a active-matrix type luminescent panel containing a light emitting device characterized by comprising the following arranged at matrix form, a holding circuit which accumulates and holds data signal current, and a driver element which drives each of said light emitting device according to this held voltage.
A setting-out means to set up two or more subfield periods within a unit frame period corresponding to synchronous timing of an input video data.
Each line of said luminescent panel is sequentially scanned for said every subfield period, A display control means which makes said light emitting device emit light according to said input video data, and a luminescence means for stopping which makes each luminescence of said light emitting device stop to each of two or more of said subfield periods when each light emission period of said light emitting device reaches at a predetermined light emission period.

[Claim 2]The display according to claim 1, wherein said luminescence means for stopping makes luminescence of said light emitting device stop for every line of said luminescent panel.
[Claim 3]The display comprising according to claim 1 or 2:
Said luminescence means for stopping is a timer.
A switching circuit which intercepts each flow of said driver element according to an output of said timer.

[Claim 4]The display according to claim 3, wherein said switching circuit is connected in series between said driver element and said holding circuit.
[Claim 5]The display according to claim 3, wherein said switching circuit is connected in parallel with said holding circuit.
[Claim 6]The display according to claim 3, wherein said switching circuit has at least the 2nd switch element connected in parallel with the 1st switch element connected in series between said driver element and said holding circuit, and said driver element.
[Claim 7]The display according to claim 3, wherein said switching circuit is connected to said light emitting device in series.
[Claim 8]said predetermined light emission period -- subfield 2^n -- gradation -- a display given in claims 1 thru/or 7 characterized by what is defined based on a method.

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention]This invention relates to an active matrix type display and the display which used the active-matrix type luminescent panel which has light emitting devices, such as an organic electroluminescence element, especially.
[0002]
[Description of the Prior Art]The organic electroluminescence element (an organic EL device is called hereafter) can control the light emitting luminance by the current which flows through a light emitting device, and development of the matrix type display using the luminescent panel constituted by arranging such a light emitting device to matrix form is furthered widely. As a luminescent panel using this organic EL device, there are a passive-matrix type luminescent panel which has only arranged the organic EL device to matrix form, and a active-matrix type luminescent panel which added the driver element which becomes each of the organic EL device which has arranged to matrix form from a transistor. Compared with a passive-matrix type luminescent panel, a active-matrix type luminescent panel is low power consumption, and has an advantage, like there are few cross talks between pixels, and fits the big screen display and the high definition display especially.
[0003]Drawing 1 shows one example of the circuitry corresponding to the one pixel 10 of the conventional active-matrix type luminescent panel. This circuitry is indicated by JP,8-241057,A, for example. In drawing 1, the gate G of FET(Field Effect Transistor) 11 (transistor for address selections). It is connected to the address scan electrode line (address line) with which an address signal is supplied, and the sauce S of FET11 is connected to the data electrode line (data line) by which a data signal is supplied. It is connected to the gate G of FET12 (transistor for a drive), and the drain D of FET11 is grounded through the capacitor 13. It is grounded, the drain D is connected to the negative pole of the organic EL device 15, and the sauce S of FET12 is connected to the power supply through the anode of the organic EL device 15. If emission control operation of this circuit is described, if ON state voltage is supplied to the gate G of FET11 in drawing 1, FET11 will send first the current corresponding to the voltage of the data supplied to the sauce S from the sauce S to the drain D. FET11 will become that the gate G of FET11 is OFF state voltage with what is called cutoff, and the drain D of FET11 will be in an open condition. Therefore, the gate G of FET11 is charged during the ON state voltage, and the voltage of the sauce S is charged by the capacitor 13, The voltage is supplied to the gate G of FET12, the current based on the gate voltage and source voltage flows into the sauce S from the drain D through the organic EL device 15 FET12, and the organic EL device 15 is made to emit light. If the gate G of FET11 becomes OFF state voltage, FET11 will be in an open condition, the voltage of the gate G will be held by the electric charge accumulated in the capacitor 13, FET12 will maintain driving current till the next scan, and luminescence of the organic EL device 15 will also be maintained. Since gate input capacity exists between the gate G of FET12, and the sauce S, even if it does not form the capacitor 13, the same operation as the above is possible.
[0004]The circuit corresponding to 1 pixel of the display panel which performs emission control by an active matrix driven is constituted in this way, and when the organic EL device 15 of the pixel concerned drives, luminescence of the pixel concerned is maintained. Control of the luminance gradation of each pixel of the above-mentioned active-matrix type luminescent panel was performed by carrying out amplitude modulation of the voltage concerning the gate G of FET12. That is, since the sauce drain current of FET12 changes with the voltage concerning the gate G, the amount of driving current which flows into the organic EL device 15 can be adjusted by adjusting the size of the voltage impressed to the gate G according to the inputted video signal supplied. Therefore, the instant luminosity of the organic EL device 15 was adjusted by adjusting the amount of driving current of the organic EL device 15.
[0005]
[Problem(s) to be Solved by the Invention]However, in the display which performs a luminance gradation display by amplitude modulation which was mentioned above, Since the relation between the pressure value concerning the gate of drive FET and the current value which flows between sauce drains, i.e., the current/voltage characteristics of drive FET, is nonlinear, Luminance gradation showed dispersion with characteristic dispersion between drive FET within a display panel surface, and there was a problem that a high-precision multi-gradation display was difficult.
[0006]This invention is made in view of this point, and there is a place made into the purpose in providing the active-matrix type display in which the highly precise multi-gradation display which continues all over a display panel and does not have dispersion in luminance gradation is possible.
[0007]
[Means for Solving the Problem]A light emitting device by which a display by this invention has been arranged at matrix form, and a holding circuit which accumulates and holds data signal current, It is a display using a active-matrix type luminescent panel containing a driver element which drives each of a light emitting device according to held this voltage, A setting-out means to set up two or more subfield periods within a unit frame period corresponding to synchronous timing of an input video data, A display control means which scans each line of a luminescent panel sequentially for every above-mentioned subfield period, and makes a light emitting device emit light according to two or more above-mentioned input video datas, When address periods which are periods which a scan of all the lines of a luminescent panel takes to a light-emitting control means to each of a subfield period are longer than a predetermined light emission period, When each light emission period of a light emitting device

reaches at a predetermined light emission period, it is characterized by having a luminescence means for stopping which makes each luminescence of a light emitting device stop.
[0008]The above-mentioned luminescence means for stopping makes luminescence of a light emitting device stop for every line of a luminescent panel as other features of this invention. The above-mentioned luminescence means for stopping has a switching circuit which intercepts each flow of a driver element according to an output of a timer and a timer as other features of this invention. The above-mentioned switching circuit is connected in series between a driver element and a holding circuit as other features of this invention.
[0009]As further feature of this invention, the above-mentioned switching circuit is connected in parallel with a holding circuit. The above-mentioned switching circuit is connected to a light emitting device in series as other features of this invention.
[0010]
[Embodiment of the Invention]The example of this invention is described in detail, referring to drawings. In the figure explained below, the same reference mark is substantially given to the equivalent portion. Drawing 2 shows roughly the composition of the organic electroluminescence display 20 using the active-matrix type luminescent panel which is the 1st example of this invention.
[0011]In drawing 2, the analog-to-digital (A/D) converter 21 is changed into digital video signal data in response to an analog video signal input. The digital video signal acquired by conversion is supplied to the frame memory 24 from A/D converter 21, and the digital video signal data of an one-frame unit is once memorized by the frame memory 24. On the other hand, the display control part (a controller is called hereafter) 26 which controls each part in the organic electroluminescence display 20, By two or more subfields (below, the case of eight subfields is explained to an example) which make different emission time a parameter. By controlling the digital video signal data memorized by the above-mentioned frame memory 24 using the sequence address counter 2 and the line address counter 23, It changes into a gradation indicative data [two or more (here eight pieces)], and the multiplexer 25 is supplied one by one with luminescence and nonluminescent data corresponding to the address of the pixel of the luminescent panel 30, respectively.
[0012]The controller 26 is controlled to make the string data corresponding to each subfield hold to the data latch circuit which the column driver 28 has in the arrangement order of a pixel one by one from the 1st line out of luminescence and nonluminescent data supplied to the multiplexer 25. The controller 26 supplies the string data for every subfield held one by one by the data latch circuit to the luminescent panel 30 per line, and it is made to emit light simultaneously in the pixel row which a line corresponding with the line drivers 27 has. the controller 26 -- a time check -- it has a device (timer) inside (not shown), the emission control driver 31 is controlled, and the light emission period of each pixel is controlled for every subfield. This operation is a data unit of one frame, and is performed about each string data from the 1st subfield to the 8th subfield (here, carried out 8 times). To each of each subfield supplied, emission control only of the predetermined light emission period mentioned later is carried out, and each pixel of the luminescent panel 30 can perform the light-emitting display for one frame by a multi-gradation display.
[0013]In [as shown in drawing 3] this example, 1 frame period in the above-mentioned inputted video signal is divided into eight subfields, the relative ratio of the luminosity within each subfield period -- respectively -- 1/2, 1/4, 1/8, 1/16, 1/32, 1/64, and 1/256 (.) That is, it is set up become order with the 1st subfield - the 8th subfield, and 256 kinds of luminance gradation displays (namely, subfield 2^n gradation display by the method based on a method) can be made with the alternative combination of those subfields.
[0014]The organic electroluminescence display in this invention is constituted in this way, and can perform the light-emitting display of a frame unit by a multi-gradation display to the analog video signal inputted by repeating the emission control by the address scan of the whole screen of a luminescent panel for every subfield. Drawing 4 shows the circuitry corresponding to 1 pixel of the active-matrix type luminescent panel which is the 1st example of this invention. That this example differs from the circuitry of the conventional technology shown in drawing 1, It is the point that the switching circuit 32 which controls the flow of FET12 for a drive and controls [of the organic EL device 15 / luminescence and nonluminescent (luminescence stop)] is formed between the node of the sauce S of FET11 for address selections, and the capacitor 13, and the gate G of FET12 for a drive. The switching circuit 32 has two FET 33 and 34 which switches according to the emission control signal from the emission control driver 31 mentioned later. In the switching circuit 32, FET33 is connected between the node of the sauce S of FET11, and the capacitor 13, and the gate G of FET12, and FET34 is connected between the gate G of FET12, and the ground (GND). Therefore, when FET33 flows and FET34 is un-flowing, the switching circuit 32 performs (ON) emission control which makes the organic EL device 15 emit light, and when [that] reverse, it performs emission control which makes luminescence of the organic EL device 15 stop (OFF).
[0015]It explains in detail, referring to the time chart shown in drawing 5 and drawing 6 for the emission control operation which the controller 26 controls luminescence and the nonluminescent one of the luminescent panel 30 below based on the digital video signal data memorized by the frame memory 24, and realizes a multi-gradation display below. First, the controller 26 will write the digital video signal data for one frame in the frame memory 24, if digital video signal data is supplied to the frame memory 24. Next, the controller 26 issues instructions of the purport that the data of the 1st subfield (SF1) is outputted to the multiplexer 25. Next, the controller 26 issues instructions of the purport that the 1st line is specified to the line address counter 23, and it issues instructions of the purport that the 1st row is specified to the sequence address counter 22.
[0016]The digital video signal data for one frame of the specified address (the 1st line, the 1st row) by this, It is changed into eight gradation indicative datas corresponding to each subfield, and the multiplexer 25 is supplied one by one as data having contained luminescence and nonluminescent data corresponding to the address of the pixel of the luminescent panel 30. The controller 26 outputs the data of the 1st subfield to the column driver 28 out of the data of the address (the 1st line, the 1st row) which was supplied to the multiplexer 25 and which was specified [above-mentioned]. In the column driver 28, this data is held by the data latch circuit (not shown) provided in the column driver 28.
[0017]Next, the controller 26 issues the instructions which update one sequence to the sequence address counter 22. That is, instructions of the purport that the 2nd row is specified to the sequence address counter 22 are issued. The same operation as the case where the address (the 1st line, the 2nd row) was specified by this, and the address (the 1st line, the 1st row) described previously is specified is repeated. Thus, the controller 26 is made to hold to the data latch circuit where the column

driver 28 has data of all the sequences of the 1st line by repeating the above-mentioned operation successively to each sequence of the 1st line.

[0018]After all the string data of the 1st line are latched, the controller 26 writes each of string data of the 1st line in the pixel of each corresponding sequence at drawing 5 so that it may be shown. That is, you make it flow through FET11 for address selections corresponding to each pixel. Can come, simultaneously the control signal which the controller 26 controls [control signal] the emission control driver 31, and makes it flow through the switching circuit 32 (emission control ON) is made to supply, and the organic EL device of the pixel which has data in which luminescence is shown is made to emit light. The controller 26 supplies the signal which directs the stop of luminescence of the above-mentioned organic EL device to the emission control driver 31, when the predetermined light emission period (T_{L1}) beforehand decided to the 1st subfield passes further. The emission control driver 31 supplies the control signal (emission control OFF) which makes luminescence of an organic EL device stop to all the switching circuits 32 of the 1st line, and an organic EL device serves as nonluminescent.

[0019]The controller 26 issues instructions of the purport that the line address counter 23 is specified as the 2nd line, as a step after all the string data of the 1st line were latched, and it issues instructions of the purport that the sequence address counter 22 is specified as the 1st row. Like the above-mentioned operation in the 1st line, control is performed so that the data latch of all the string data of the 2nd line may be performed. Emission control operation of the pixel of each sequence of the 2nd line is performed like the case of the 1st above-mentioned line after the 2nd-line latch of all the string data.

[0020]By covering all the lines (namely, the 1st line - the m-th line), and performing such operation, the controller 26 can make the data of the 1st subfield able to respond, and can perform emission control of all the pixels of the luminescent panel 30. Next, the controller 26 emits instructions of the purport that the data of the 2nd subfield is outputted to the multiplexer 25. The controller 26 repeats hereafter the same operation as the case of the 1st subfield described previously, and luminescence corresponding to the data of the 2nd subfield is made.

[0021]Thus, although luminescence which corresponded even to the 8th subfield from the 1st subfield is made, Since it has a means to make luminescence of a light emitting device stop, as a feature in this invention after a predetermined light emission period passes for every subfield, it is possible to assign arbitrary light emission periods shorter than address periods (T_A) to a subfield. That namely, a light emission period shorter than address periods cannot be assigned to a subfield when it does not have a luminescence means for stopping, It is because luminescence of the pixel which was emitting light until luminescence (or nonluminescent) of the pixel was updated by the start of the address periods of the next subfield cannot be stopped, and the next subfield cannot be started until the address periods which are periods which the scan of all the lines takes expire.

[0022]Drawing 5 shows the case where luminescence of each line is controlled by a light emission period shorter than address periods (T_A), to the k-th subfield (1<=k<=8). Emission control of each line is carried out in the predetermined light emission period (T_{Lk}) set up to this subfield by the control same with having mentioned [which is depended on the controller 26] above. For example, when displaying one frame at 60 Hz, one frame is about 16.7 milliseconds (ms). The case where a light emission period [in / for address periods / 0.84 ms (40%x1/8 of 1 frame period) and the 1st subfield (1/2)] is set here, respectively to 1/2 or less value of 1 frame period, for example, 5 ms, is explained to an example. At this time. 2.5 ms, 1.25 ms, 0.625 ms, ... whose light emission periods in the subfield after the 2nd subfield are $1/2^1$ of the light emission period of the 1st subfield, $1/2^2$, $1/2^3$, ..., $1/2^7$, respectively, It has been 0.039 ms. Therefore, in this case, although the light emission period in the subfield (the 4th - the 8th subfield) after the 4th subfield is shorter than address periods (T_A=0.84ms), control is made so that it may have a desired light emission period to each subfield.

[0023]As it described above, when the display control from the 1st subfield to the 8th subfield is completed, the display of one frame is completed. Then, the controller 26 rewrites the data memorized by the frame memory 24 to the data corresponding to the following frame, and performs display control of the following frame. Therefore, according to this invention, since luminescence is controllable by arbitrary light emission periods shorter than address periods to each subfield by the luminescence stop control mentioned above, an extensive gradation display is possible.

[0024]Drawing 7 shows the circuitry corresponding to 1 pixel of the active-matrix type luminescent panel which is the 2nd example of this invention. That this example differs from the 1st example is the point that the switching circuit 32 has FET35 connected in parallel with the capacitor 13. That is, the drain D of FET35 is connected at the sauce S of FET11, and the node of the capacitor 13, and the sauce S is grounded in the ground. Therefore, it is stopped by luminescence of the organic EL device 15 when FET35 flows according to the control signal supplied to the gate G.

[0025]Drawing 8 shows the circuitry corresponding to 1 pixel of the luminescent panel which is the 3rd example of this invention. That this example differs from the above-mentioned example is the point that the switching circuit 32 has FET36 connected with the capacitor 13 in series between the gates G of FET12. That is, the drain D of FET36 is connected at the sauce S of FET11, and the node of the capacitor 13, and the sauce S is connected to the gate G of FET12. Therefore, it is stopped by luminescence of the organic EL device 15 when FET36 is un-flowing according to the control signal supplied to the gate G.

[0026]Drawing 9 thru/or 11 show the circuitry corresponding to 1 pixel of the luminescent panel which are other examples of this invention, respectively. That each example differs from the above-mentioned example is the point that the switching circuit 32 has FET37 connected with the organic EL device 15 in series. That is, it is stopped by luminescence of the organic EL device 15 when FET37 is un-flowing according to the control signal supplied to the gate G of FET37.

[0027]As described above, according to this invention, since luminescence is controllable by arbitrary light emission periods shorter than address periods to each subfield, an extensive gradation display is realizable by the luminescence stop control mentioned above. Each numerical value shown in the above-mentioned example is an example, and may be changed suitably. Various kinds of switching circuits can be combined suitably, and can be used.

[0028]

[Effect of the Invention]Since the light emission period in each subfield is arbitrarily controllable clearly from having described above according to this invention, the active-matrix type display in which the highly precise multi-gradation display which continues all over a display panel and does not have dispersion in luminance gradation is possible is realizable.

[Translation done.]